AUSTRALUCO
ALUMINIUM
DATA

AUSTRALIAN ALUMINIUM COMPANY PTY. LTD.
GRANVILLE NSW

YU 2321

NORTH TECH. Aust Alum
Swinburne Charge North Dept

INTRODUCTION

To industry aluminium has become a generic term, covering not only the element aluminium, but a wide range of aluminium alloys, each designed to have specific characteristics to suit it for a particular purpose.

This booklet sets out information on various aspects of the wide range of Australuco aluminium alloys and commodities.

Should you require further information we have available a wide range of publications dealing with specific characteristics of our products.

ABOUT *AUSTRALUCO*

Australian Aluminium Company Pty. Ltd. commenced production of a wide range of semi-fabricated aluminium and aluminium alloy commodities at Granville, N.S.W., during 1941. For the first time in Australia a complete range of rolled, extruded, drawn and forged commodities was available from one source.

Although planned to produce aluminium for peace time applications, during the first four years Australuco's output went entirely to the armed services principally for aircraft construction.

Since 1945 Australuco has been supplying semi-fabricated aluminium to Australian industry on an ever increasing scale. Expansion of production capacity to keep pace with demand has continued steadily and expansion programmes of both rolling and extrusion plant are based on a long and optimistic view into the future.

Australuco is the only semi-fabricator in Australia who can supply all your requirements of aluminium.

ABOUT *AUSTRALUCO* TECHNICAL SERVICE

As part of its service to Australian industry Australuco maintains a Sales Development Department staffed with fully qualified Engineers, Metallurgists and other specialists who are available at all times to assist in solving your technical problems and developing new uses for aluminium.

Close liaison is maintained with the research establishments of our associated organisations in the U.K. and North America, thus gaining access to the latest developments in those countries. Australuco's Technical Service is at the disposal of Australian industry.

ABOUT ALUMINIUM

Within one life span aluminium has developed from a laboratory curiosity to a major industrial material. To-day there is a greater volume of aluminium used than all the other non-ferrous metals added together. In the world of metals it is second only to steel. World production for 1956 will be well in excess of 3,000,000 tons.

In 1885 Charles Martin Hall in the U.S.A., and Paul Heroult in France, discovered simultaneously the electrolytic process for the reduction of alumina to metallic aluminium. The discovery of this process made aluminium available at a price which established it as a commercial metal. Developments in alloying and processing extended applications for this modern metal until to-day it is an essential raw material in many industries.

The principal factors in order of importance in the production of aluminium are electric power, bauxite, carbon electrodes and cryolite. Because of the large amount of electric power consumed, 9 k.w.h. to 1 lb. of aluminium, reduction plants are always located close to abundant supplies of low cost electricity—close to large hydro electric projects. The efficiency of power generation is continually improving, which in turn will lead to an equivalent reduction in the relative price of aluminium.

A unique range of characteristics makes aluminium and its alloys the most versatile of all commercial materials. Light weight and strength, durability, high heat conductivity, high reflectivity and high electrical conductivity are some of the fundamental characteristics, while ease of working, ease of joining and ability to take pleasing decorative finishes all add up to a material which, in its wide variety of applications, helps to make life easier and more pleasant.

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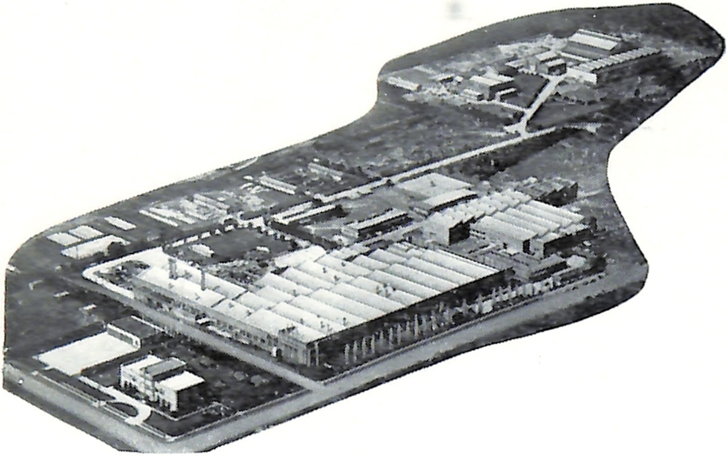

AUSTRALUCO WORKS AT GRANVILLE

Where is made the following wide range of Australuco Aluminium Products

GENERAL

- Sheet
- Strip
- Circles
- Plate
- Rod
- Bar
- Solid Sections
- Hollow Sections
- Extruded Tubing
- Drawn Tubing
- Wire
- Forgings
- Foundry Alloy Ingot

SPECIAL

- Irrigation Tubing
- Bus-Bar
- Free Machining Rod
- Impress Sheet
- Impact Extrusion Slugs
- Commercial — Anodic Quality Sheet

AUSTRALUCO ALUMINIUM ALLOYS

CHEMICAL ANALYSIS

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WROUGHT ALLOYS

ALLOY	Nominal Composition % Aluminium the Remainder						STANDARD COMMODITIES
	Si	Cu	Mn	Mg	Cr		
AA.1S		99.5% min. aluminium					Sheet, Extrusions, Drawn Tubing and Wire
AA.2S		99.0% min. aluminum					Sheet, Extrusions, Drawn Tubing and Wire
AA.3S			1.3				Sheet
AA.B26S		4.15	0.7	.85			Sheet and Extrusions
AA.33S	5.3						Sheet, Extrusions and Wire
AA.50S	0.5			0.7			Extrusions, Drawn Tubing and Wire
AA.51S	1.0			0.9			Extrusions and Tubing
AA.54S	0.5			3.6			Sheet and Extrusions
AA.M57S				2.1			Sheet
AA.B62S	1.0	1.8	0.7	1.0		Bi + Pb 1.5	Extrusions, principally machining rods and bars
AA.65S	0.7	0.3		1.0	0.3		Sheet, Drawn Tubing and Wire

N4

CAST ALLOYS

ALLOY	Nominal Composition % Aluminium the Remainder				
	Si	Cu	Mn	Mg	Ni
AA.117	5.0	3.5	0.5		
AA.123	5.25				
AA.127	5.0	4.0			
AA.135	7.0			0.3	
AA.143	9.5	2.8			
AA.160	11.5				
AA.218		4.0		1.5	2.05
AA.225	1.0	4.5			
AA.226		4.5			
AA.320			0.45	4.0	
AA.350				10.25	

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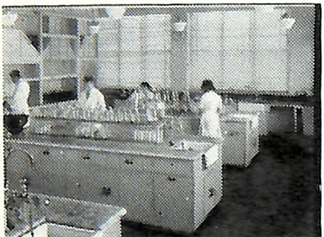
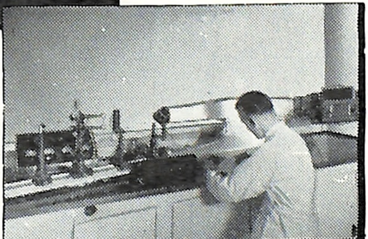
AUSTRALUCO ALUMINIUM AND ALUMINIUM ALLOYS

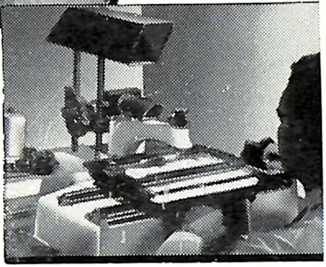
QUALITY CONTROL



Laboratory for the volumetric and gravimetric analysis of aluminium alloys.



Spectrographic analysis of aluminium alloys. Exposure of photographic plate.



Spectrographic analysis of aluminium alloys. Measurement of density of exposed photographic plate.

In Australuco's well equipped mechanical and chemical laboratories a constant check is kept on the quality of aluminium commodities produced in the plant. Here problems encountered in the manipulation and finishing of aluminium alloys are solved and new alloys developed to meet ever-growing demands. This "technical brain" of the Company is constantly alert to ensure that the high quality of Australuco aluminium is maintained, and that the latest devolpments in production technique are introduced.

AUSTRALUCO ALUMINIUM ALLOYS

TEMPER DESIGNATION

—F	AS FABRICATED: Applies to products supplied in the as manufactured condition, i.e. not heat treated, or strain hardened after production.
—O	ANNEALED (WROUGHT PRODUCTS ONLY): The softest temper for wrought alloy products.
—H	STRAIN HARDENED TEMPER: Hardened by cold working.

Subdivision of the —H Temper:

—H1	STRAIN HARDENED ONLY: No. 1. is followed by a second number indicating the degree of strain or work hardening, e.g. —H18 fully hard material, —H14 half hard, i.e. mid-way between soft and fully hard.
—H2	STRAIN HARDENED AND PARTIALLY ANNEALED: Indicates rolling to hard temper during production and partially annealed to an intermediate temper, such as —H22 or —H26.
—H3	STRAIN HARDENED AND THEN STABILISED: Used principally for alloys which unless they are stabilised, age soften at room temperature.
—T	STABLE TEMPERS OTHER THAN —F, —O, or —H PRODUCED BY HEAT TREATMENT:

Subdivision of the —T Temper:

—T2	ANNEALED (CAST PRODUCTS ONLY): Indicates a type of annealing or stabilising treatment which improves ductility and increases dimensional stability.
—T3	SOLUTION HEAT TREATED AND THEN COLD WORKED: Applies to products which are cold worked after solution treatment to improve their strength or to products where the effect of cold work applied during flattening operations after solution treatment is critical.
—T4	SOLUTION HEAT TREATED AND NATURALLY AGED TO SUBSTANTIALLY STABLE CONDITION: Applies to products which are solution heat treated and subsequently flattened or rectified.

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Australuco ALUMINIUM ALLOYS

TEMPER DESIGNATION

(CONTINUED)

—T4A	A TYPE OF SOLUTION HEAT TREATMENT OBTAINED BY QUENCHING IN WATER: Applies to extruded sections only, is similar to —T4.
—T5	ARTIFICIALLY AGED AFTER SOLUTION TREATMENT BY QUENCHING: Products treated to produce a —T4A temper may be artificially aged to the —T5 temper to improve their mechanical properties and/or dimensional stability.
—T6	SOLUTION HEAT TREATED AND THEN ARTIFICIALLY AGED: Products heat treated to the —T4 temper may be artificially aged to the —T6 temper to improve their mechanical properties and/or dimensional stability.
—T7	SOLUTION HEAT TREATED AND THEN STABILISED: Applies to products treated to the —T4 condition and then given a stabilising treatment which carries the alloy past the point of maximum hardness and provides control of growth and/or residual stress.
—T8	SOLUTION HEAT TREATED, COLD WORKED AND THEN ARTIFICIALLY AGED: Products heat treated to the —T4 temper and then given a specific amount of cold work prior to the artificial ageing for the purpose of improving their strength are designated —T8.
—T9	SOLUTION HEAT TREATED, ARTIFICIALLY AGED AND THEN COLD WORKED: Similar to —T8 except that the cold working is applied after artificial ageing for improving strength.
—T10	ARTIFICIALLY AGED AND THEN COLD WORKED: Products which are artificially aged without prior solution heat treatment then cold worked for the purpose of improving strength.

DURABILITY

Aluminium has excellent resistance to weathering, owing to the thin oxide coating that covers the metal at all times. Aluminium alloys, however, like all common metals, are affected to some extent by the action of chemical compounds in the atmosphere. These compounds tend to roughen the surface of the metal. Once the initial stage of roughening has been reached the protection afforded by the oxide film is complete.

From the point of view of durability, only where aluminium is to be used in actual contact with chemicals or chemical solutions is it considered necessary to obtain expert advice regarding the selection of the correct alloy.

Whenever two dissimilar metals are in contact under moist conditions very small electric currents will flow and metal will be removed from the surface which has the higher electrolytic potential Aluminium is near the top of the scale in this respect and when connected to any one of most other metals loses metal if galvanic action is allowed to take place. Zinc is an exception, being sacrificial to aluminium in the presence of moisture. Consequently when aluminium is to be joined to a dissimilar metal it is necessary to insulate it effectively to prevent any chance of galvanic action developing should moisture be present.

Insulation may be affected by an inert non metal packing or paint film, such as zinc chromate or bituminous. Lead packings or caulkings should be avoided.

IMPORTANT: Under no circumstances should copper and brass be used in direct contact with aluminium.

CHARACTERISTICS AND USES

AA.1S:

A pure (99.5% min. Al) soft and ductile metal having high electrical conductivity and resistance to attack by various media. Will also take a very clear anodic film. Uses include chemical equipment, conductor rod, bus-bar and wire for metal spraying.

AA.2S:

Commercially pure (99.0% min. Al) metal which is soft and ductile in the annealed temper, but hardens considerably when worked by rolling, spinning or drawing. Uses include cooking utensils, decorative panelling and mouldings, packaging containers, building components and in domestic appliances.

AA.3S:

An alloy of commercially pure aluminium to which has been added 1¼% manganese for additional strength. Uses include roofing, rain-water goods, wall panels, panelling for road vehicles, food containers, bottle closures, etc.

AA.B26S:

This alloy is one of the strongest alloys available in wrought form. It has a tensile strength of approximately 30 tons per

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AUSTRALUCO ALUMINIUM ALLOYS
CHARACTERISTICS AND USES

(CONTINUED)

square inch. Uses include highly stressed components in aircraft, structural and general engineering.

AA.33S:

A 5% silicon aluminium alloy originally developed for the production of welding rods. Latest developments have extended its use to sheet and extrusions for curtain wall construction and other architectural components. The alloy develops a range of grey colours under various anodising conditions and these colours are completely light-fast.

AA.50S:

This alloy is particularly suitable for polishing and anodising for decorative work. Uses include glazing bars, window sections, handrails, skirting boards and other architectural and decorative items, automotive sections, light duty structural framework, decorative and funtional sections for domestic appliances.

AA.51S:

This alloy is similar to AA.50S, but with increased strength. Heat treatment gives an increased tensile strength of approximately 20 tons p.s.i. It has excellent corrosion resistance and may be welded. Uses include structural members of road and rail transport vehicles and for ships and small craft, general structural and architectural work, scaffolding, ladders and for forgings.

AA.54S:

This alloy has a high tensile strength (12½ tons per square inch) in the annealed temper. The alloy hardens rapidly with small amounts of work and has excellent corrosion resistance and weldability. Its principal uses in the form of sheet, plate and sections are welded marine constructional work and welded road transport vehicles.

AA.M57S:

An alloy similar to AA.54S which is reasonably ductile and readily worked in the annealed condition. Its work hardens rapidly and attains reasonably high tensile properties. Is satisfactory for welding and has a high resistance to corrosive attack. With prior removal of the discoloured surface films by acid or alkaline etching a relatively clear anodic film may be applied. Uses include panelling and pressings for road and rail vehicles, boxes and containers, light marine craft and panels subjected to salt atmospheres, and fencing wire.

AA.B62S:

This alloy is similar in its strength characteristics to AA.B26S. The addition of lead and bismuth to this alloy imparts to it excellent free machining and chip breaking characteristics. Its primary use is for repetition parts produced on automatic machines, i.e. screws, nuts, bolts, and hinges.

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AUSTRALUCO ALUMINIUM ALLOYS

(CONTINUED)

AA.65S:

This alloy is similar in chemical composition and mechanical properties and physical characteristics to alloy AA.51S. It is supplied principally as sheet and plate for sea, road and rail transport, mine skips and heavy duty containers.

Commercial Anodic Quality Sheet

IMPORTANT: It should be noted that all aluminium alloys can be anodised, i.e. their surface oxide film may be thickened and dyed any desired colour as required. However, upon anodising such commercial alloys NO GUARANTEE CAN BE GIVEN THAT THEY WILL BE FREE OF WHITISH STREAKS OR SIMILAR MARKINGS AND MECHANICAL DAMAGE, such as scratches and scuffs, which will mar their appearance after anodising. Commercial anodising quality sheet, on the other hand, has been given special surface treatment to eliminate these defects as far as possible.

AA.X1008 and AA.X1005, have been specially developed for the production of commercial anodising quality sheet.

AA.X1008:

AA.X1008 is used for applications which require a decorative anodised finish subsequent to deep drawing, spinning or other severe working operations, and mechanical polishing. It is also particularly suitable for chemical brightening prior to anodising. This process increases the brilliance of subsequently applied anodic films.

AA.X1005:

AA.X1005 is for the manufacture of articles requiring moderate stiffness after mechanical working, such as deep drawing or spinning. When the surface is mechanically polished after such operations and anodised or chemically brightened and anodised, the resultant anodic film has a clear bright lustre.

AA.M57S:

AA.M57S is produced as commercial anodising quality sheet as well as commercial sheet. Its field of application is for articles which require maximum strength and rigidity and also a relatively even anodic film, following mechanical finishing and anodising. The lustre of the anodic film on this article will not be as clear or bright as that obtainable on alloys AA.X1008 or AA.X1005. Its strength characteristics are considered to be more important than the decorative qualities of its anodic film.

The above three alloys are available as flat sheet or circles only and in a minimum gauge of .036" and up to a maximum gauge of .080". Alloys AA.X1008 and AA.X1005 are available in the O (soft), H14 (half hard) and H18 (fully hard) tempers, while AA.M57S is only available in H32 (quarter hard) and H34 (half hard) tempers as commercial anodising quality.

NOTE: For process details refer section on FINISHING.

AUSTRALUCO ALUMINIUM ALLOYS

MECHANICAL PROPERTIES

WROUGHT ALLOYS

Alloy and Temper	0.1% Proof Stress lb./sq. in. Min.	Ultimate Tensile Stress lb./sq. in. Min.	Elongation % on 2″	Vickers Hardness Typical
AA.1S—O	—	14,000 Max	30	—
AA.1S—H14	—	15,000	8	—
AA.1S—H24				
AA.1S—H18	—	19,000	—	—
AA.2S—F	—	—	—	25
AA.2S—O	—	14,500 Max	30	20
AA.2S—H14	—	15,500	7	35
AA.2S—H24				
AA.2S—H18	—	22,000	—	50
AA.3S—O	—	18,000 Max	30	30
AA.3S—H14	—	19,500	7	45
—H24				
AA.3S—H18	—	27,000	—	65
AA.33S—O	—	18,000 Max	25	30
AA.33S—H14	—	20,000	6	50
AA.33S—H18	—	28,000	—	—
AA.50S—T4A	9,000	18,000	16	50
AA.50S—T5	21,000	27,000	8	85
AA.51S—T4	16,000	27,000	18	70
AA.51S—T6	34,000	40,000	10	105
AA.54S—F	13,500	31,000	18	70
AA.54S—O	12,000	30,000	18	—
AA.54S—H32	24,500	38,000	8	—
AA.M57S—O	—	30,000 Max	20	50
AA.M57S—H34	27,000	33,500	7	75
AA.M57S—H38	31,500	38,000	5	80
AA.B62S—T4	22,000	38,000	15	90
AA.B62S—T6	45,000	56,000	8	145
AA.65S—T4	15,000	30,000	16	75
AA.65S—T6	34,000	42,000	10	110

These figures apply to typical thickness of sheet (.104") and extruded sections (up to .125"). Lighter and heavier thicknesses may vary slightly.

AUSTRALUCO ALUMINIUM ALLOYS

MECHANICAL PROPERTIES

CAST ALLOYS

Alloy Temper and Method of Casting	Ultimate Tensile Stress lb./sq. in. Min.	Elongation % on 2" Min.	Brinell Hardness Typical
AA.117—F			
S	21,000	2	65
P	23,000	2	70
AA.123—F			
S	17,000	3	40
P	19,000	4	50
D	25,000	3	—
AA.127—F			
D	40,000 (Typical)	3.5 (Typical)	—
AA.135—F			
S	16,000	—	—
P	18,000	1	—
AA.135—T4			
S	22,000	2	55
P	24,000	3	60
AA.135—T6			
S	28,000	1	70
P	30,000	1	—
AA.143—F			
S	18,000	—	65
P	22,000	1	75
D	26,000	1	75
AA.160—F			
S	23,500	5	50
P	27,000	7	60
D	33,000	2	65
AA.218—F			
S	22,500	—	85
P	27,000	—	90
AA.218—T4			
S	31,500	—	100
P	40,000	—	110
AA.218—T6			
S	32,000	—	105
P	40,000	—	110
AA.225—T4			
S	29,000	6	60

S = Sand. P = Permanent Mould.

D = Pressure Die.

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AUSTRALUCO ALUMINIUM ALLOYS

MECHANICAL PROPERTIES

CAST ALLOYS (Continued)

Alloy Temper and Method of Casting	Ultimate Tensile Stress lb./sq. in. Min.	Elongation % on 2″ Min.	Brinell Hardness Typical
AA.225—T6			
S	34,000	3	90
AA.226—T4			
S	31,500	7	80
P	38,000	13	90
AA.226—T6			
S	40,500	4	100
P	45,000	9	105
AA.320—F			
S	20,000	6	50
AA.350—T4			
S	36,000	7	95

S = Sand. P = Permanent Mould.
D = Pressure Die.

GENERAL CHARACTERISTICS COMPARED WITH OTHER METALS

ALLOY	Density gm/cc.	Heat Cond. at 25°C C.G.S.	Elect. Cond. at 20°C % * of I.A.C.S.	Co-eff. of Lin. Exp. per °C x 10^6	Elastic Modulus p.s.i. x 10^6
AA.1S—O	2.71	0.57	61	23.8	10.0
AA.2S—O	2.71	0.53	59	23.6	10.0
AA.50S—T5	2.69	0.43	52	23.6	9.5
AA.54S—O	2.65	0.30	32	25.0	10.0
AA.M57S—O	2.66	0.32	40	25.0	10.0
AA.65S—T6	2.71	0.37	40	23.5	10.0
Copper	8.90	0.92	100	17.2	17.0
Zinc	6.64	0.265	27	29.3	14.2
Lead	11.34	0.082	7.8	28.5	2.6
Tin	7.3	0.147	11	21.8	7.8
Steel	7.85	0.174	12	10.8	28.0
Stainless Steel	7.90	0.098	2.4	17.0	29.0
Brass	8.46	0.286	26	18.7	13.8

* International Annealed Copper Standard.

Australuco ALUMINIUM ALLOYS

STRENGTH AT ELEVATED TEMPERATURES

Containers operating at pressures above atmospheric are sometimes called upon to withstand elevated temperatures. Properties at elevated temperatures for the normal alloys used for this purpose are set out below.

ALLOY AA.	TEMPERATURE °C	0.2% PROOF STRESS p.s.i.	U.T.S. p.s.i.	ELONGATION % on 2″ (1)
2S—O	150	3,500	7,500	65
	200	3,000	6,000	70
	250	2,000	3,500	85
	300	1,500	2,500	90
	350	1,000	1,500	95
2S—H14	150	10,000	13,000	22
	200	6,500	9,500	25
	250	2,000	3,500	85
	300	1,500	2,500	90
	350	1,000	1,500	95
3S—O	150	5,000	11,000	47
	200	4,500	8,000	50
	250	3,500	5,500	60
3S—H14	150	15,000	18,000	17
	200	9,000	14,000	22
	250	5,000	10,500	25
	300	3,000	6,000	40
	350	2,000	3,000	60
65S—T6	150	29,000	31,000	18
	200	15,000	19,000	25
	250	5,000	7,500	55
	300	2,500	3,500	90
	350	2,000	3,000	105

(1) For round specimens (½" diameter).

AUSTRALUCO ALUMINIUM ALLOYS

SHEET WEIGHT CHART

Figures Quoted are for AA.2S

AA.3S x 1.01

AA.54 x 0.970

AA.M57S x 0.980

AA.65S x 1.000

Gauge SWG or fraction of an in.	SIZE OF SHEET				
	Thickness inches	lbs. per sq. foot	72 in. x 36 in. lbs.	96 in. x 48 in. lbs.	144 in. x 48 in. lbs.
1/4″	.250	3.521	63.37	112.67	169.00
4	.232	3.267	58.81	104.55	156.83
5	.212	2.986	53.74	95.54	143.31
6	.192	2.704	48.67	86.53	129.79
3/16″	.1875	2.641	47.53	84.50	126.75
7	.176	2.479	44.62	79.32	118.98
8	.160	2.253	40.56	72.11	108.16
9	.144	2.028	36.50	64.90	97.34
10	.128	1.803	32.45	57.68	86.52
1/8″	.125	1.760	31.69	56.33	84.50
11	.116	1.634	29.41	52.28	78.42
12	.104	1.465	26.36	46.87	70.31
13	.092	1.296	23.32	41.46	62.19
14	.080	1.127	20.28	36.05	54.08
15	.072	1.014	18.25	32.45	48.67
16	.064	.9013	16.22	28.84	43.26
17	.056	.7887	14.20	25.24	37.86
18	.048	.6760	12.17	21.63	32.45
19	.040	.5633	10.14	18.03	27.04
20	.036	.5070	9.13	16.22	24.34
21	.032	.4507	8.11	14.42	21.63
22	.028	.3943	7.10	12.62	18.93
23	.024	.3380	6.08	10.82	16.22
24	.022	.3098	5.58	9.91	14.87
25	.020	.2817	5.07	9.01	13.52
26	.018	.2535	4.57	8.11	12.17
27	.0164	.2310	4.16	7.39	11.08
28	.0148	.2084	3.75	6.67	10.00
29	.0136	.1915	3.45	6.13	9.19
30	.0124	.1746	3.14	5.59	8.38

AUSTRALUCO ALUMINIUM ALLOYS

TUBING WEIGHT CHART

Figures Quoted are for AA.2S

AA.3S x 1.01.   AA.50S x 0.99.   AA.65S x 1.00.

Outside dia. inches	WALL THICKNESS — INCHES						
	.028 22 swg.	.036 20 swg.	.048 18 swg.	.064 16 swg.	.080 14 swg.	.128 10 swg.	.160 8 swg.
1/4″	.0229	.0284	.0357	.0439	.0502	—	—
5/16″	.0293	.0368	.0468	.0586	.0685	—	—
3/8″	.0358	.0450	.0579	.0733	.0870	—	—
7/16″	.0422	.0532	.0688	.0880	.106	.147	—
1/2″	.0487	.0616	.0799	.103	.124	.176	—
5/8″	.0616	.0782	.103	.132	.161	.235	.275
3/4″	.0745	.0947	.124	.162	.197	.293	.349
7/8″	.0939	.119	.157	.207	.253	.382	.458
1″	.101	.128	.169	.221	.272	.412	.495
1.1/8″	.114	.145	.190	.250	.309	.471	.570
1.1/4″	.126	.161	.213	.280	.346	.529	.643
1.3/8″	.140	.178	.236	.310	.382	.588	.717
1.1/2″	.152	.194	.257	.339	.418	.648	.789
1.5/8″	—	.212	.280	.369	.455	.706	.863
1.3/4″	—	.227	.302	.397	.492	.764	.938
1.7/8″	—	—	.323	.472	.529	.823	1.011
2″	—	—	.345	.456	.566	.883	1.084

WT. PER FOOT IRRIGATION TUBING 2" x .048" W/T. .340 lbs.
3" x .048" ,, .519 lbs.
4" x .048" ,, .696 lbs.
5" x .052" ,, .950 lbs.

AUSTRALUCO ALUMINIUM ALLOYS

ROD AND BAR WEIGHTS

Figures Quoted are for AA.2S

AAIS x 1.00, AAB62S x 1.02

AA51S x 0.99, AA50S x 0.99,

ROUNDS AND SQUARES			HEXAGONS	
Diameter of round or side of square (inches)	lbs. per foot		Width across flats	Weight lbs. per foot
	Square	Round		
1/16	0.0049	0.0039	0.191	0.037
1/8	0.0184	0.0145	0.246	0.061
3/16	0.0147	0.0320	0.277	0.078
1/4	0.0738	0.0573	0.312	9.099
5/16	0.1146	0.0903	0.322	0.108
3/8	0.1651	0.1301	0.344	0.120
7/16	0.2252	0.1767	0.375	0.142
1/2	0.2942	0.2311	0.437	0.195
9/16	0.372	0.2922	0.500	0.252
5/8	0.4592	0.3602	0.562	0.322
11/16	0.5554	0.4359	0.625	0.394
3/4	0.6612	0.5194	0.687	0.480
13/16	0.7757	0.6088	0.707	0.508
7/8	0.8991	0.7067	0.750	0.573
15/16	1.032	0.8107	0.875	0.777
1	1.175	0.9224	0.920	0.861
1-1/16	1.326	1.042	1.000	1.016
1-1/8	1.486	1.168	1.062	1.147
1-3/16	1.656	1.301	1.100	1.227
1-1/4	1.836	1.442	1.125	1.284
1-5/16	2.023	1.589	1.187	1.432
1-3/8	2.221	1.745	1.250	1.589
1-7/16	2.427	1.907	1.300	1.715
1-1/2	2.644	2.076	1.312	1.750
1-9/16	2,868	2,252	1.375	1.919
1-5/8	3.102	2.436	1.437	2.110
1-11/16	3.346	2.627	1.480	2.228
1-3/4	3.598	2.825	1.500	2.285
1-13/16	3.859	3.031	1.625	2.679
1-7/8	4.130	3.244	1.750	3.110
1-15/16	4.410	3.463	1.875	3.569
2	4.699	3.690	2.125	4.585

RECTANGLES

Thick-ness inch	WIDTH					INCH					
	1/2	5/8	3/4	7/8	1	1¼	1½	1¾	2	2½	3
1/8	.0777	.0942	.1131	.1311	.1466	.1835	.220	.2573	.2942	.367	.4408
3/16	.1107	.1408	.1689	.1971	.2204	.2757	.330	.3854	.4408	.5505	.6612
1/4	.1505	.1884	.2262	.2631	.2942	.3670	.441	.5136	.5874	.7340	.8816
5/16	.1874	.2350	.2816	.3291	.3670	.4592	.551	.6427	.7340	.9175	1.101
3/8	.2214	.2816	.3379	.3942	.4408	.5505	.661	.7709	.8816	1.101	1.313
1/2	.2942	.3748	.4554	.7839	.5874	.7340	.882	1.028	1.175	1.469	1.762

AUSTRALUCO ALUMINIUM ALLOYS

CIRCLE WEIGHT CHART

Figures Quoted are for AA.2S

AA.3S x 1.01 AA.M57S x 0.980.

Diam. inches	Thickness in S.W.G. and inches.						
	10 .128	14 .080	16 .064	18 .048	20 .036	22 .028	24 .024
2	.0394	.0246	.0197	.0148	.0111	.0086	.0068
2½	.0615	.0385	.0308	.0231	.0173	.0135	.0106
3	.0886	.0554	.0443	.0332	.0249	.0194	.0152
3½	.121	.0754	.0603	.0452	.0339	.0264	.0207
4	.157	.0984	.0787	.0591	.0443	.0345	.0271
4½	.199	.125	.0997	.0747	.0561	.0436	.0343
5	.246	.154	.123	.0923	.0692	.0538	.0423
5½	.298	.186	.149	.112	.0837	.0651	.0512
6	.354	.221	.177	.133	.0997	.0775	.0609
6½	.416	.260	.208	.156	.117	.0910	.0715
7	.482	.301	.241	.181	.136	.106	.0829
7½	.554	.346	.277	.208	.156	.121	.0952
8	.630	.394	315	.236	.177	.138	.108
8½	.711	.444	.356	.267	.200	.156	.122
9	.797	.498	.399	.299	.224	.174	.137
9½	.888	.555	.444	.333	.250	.194	.153
10	.984	.615	.492	.369	.277	.215	.169
10½	1.09	.678	.543	.407	.305	.237	.187
11	1.19	.744	.596	.447	.335	.261	.205
11½	1.30	.814	.651	.488	.366	.285	.224
12	1.42	.886	.709	.532	.399	.310	—
12½	1.54	.961	.769	.577	.433	.336	—
13	1.66	1.04	.832	.624	.468	.364	—
13½	1.79	1.12	.897	.673	.505	.392	—
14	1.93	1.21	.965	.723	.543	.422	—
14½	2.07	1.29	1.03	.776	.582	.453	—
15	2.21	1.38	1.11	.831	.623	.484	—

FOUNDRY INGOT, EXTRUDED AND ROLLED COMMODITIES

ORDERING DATA

All orders for aluminium commodities should wherever possible include the following information—

GENERAL

State if part deliveries of order are acceptable. Where items are complementary to each other state that quantities of each item in ratio to the total order must be delivered together.

Indicate clearly the delivery required.

★ SHEET & PLATE:

Quantity (in pounds, feet or number of pieces)
Alloy and Temper.
Thickness.
Length and Width (for coiled sheet, width only)
Tolerances other than standard.
Point of delivery.

★ EXTRUDED SECTIONS:

Quantity (in pounds or feet)
Alloy and Temper.
Section (our die number or print giving complete dimensions and critical tolerances)
Length classification (Random, multiples or set lengths)
Application.
Point of delivery.

(Continued Next Page)

ORDERING DATA

(CONTINUED)

★ TUBING:

Quantity (in pounds or feet)
Size (outside dimensions and wall thickness)
Section (round, square, rectangular, etc. or our die number)
Alloy and Temper.
Length classification (Random, multiples or set lengths)
Point of delivery.

★ WIRE:

Quantity
Size (Diameter)
Alloy and Temper.
Length classification (indicate whether coiled or straightened lengths are required)
Point of delivery.

FOUNDRY INGOT:

Alloy (if standard specify alloy number, if other than standard full chemical composition should be stated)
Quantity.
Size of Ingot.
Point of delivery.

★ Wherever possible details of the application, method of fabrication and surface finishing should be supplied.

AUSTRALUCO ALUMINIUM ALLOYS

LIMITS OF MANUFACTURE

ROLLED COMMODITIES

The limits given below and in the following pages cover standard sheet commodities in the common alloys and tempers only.

A Special enquiry should be made for sizes, alloys and tempers not covered by the tables.

FLAT SHEET (Standard Finish) — ALLOYS AA.2S. AA.3S.

Thickness inch	Minimum Width inch	Max. Width inch	Max. Length inch	Available Tempers
.018 — .027	1½	36	72	O, H14, H18
.028 — .035	1½	36	96	
.036 — .125	2	48	144	
.126 — .249	2½	48	144	

FLAT SHEET (Mill Finish) — ALLOYS AA.2S, AA.3S.

.010 — .017	1	24	72	O, H14, H18
.018 — .027	1	36	72	
.028 — .064	2	36	96	
.065 — .249	2½	36	96	

FLAT SHEET—ALLOY AA.M57S

.018 — .027	1½	24	72	O, H34, H38
.028 — .035	1½	36	144	
.036 — .063	2	48	144	
.064 — .249	2½	48	144	

COILED STRIP (Stand. Finish)—ALLOYS AA.2S, AA.3S

Thickness inch	Minimum Width inch	Maximum Width inch	Available Tempers
.010 — .017	2	16	O, H14, H18
.018 — .080	2	20	

COILED STRIP (Mill Finish)—ALLOYS AA.2S, AA.3S

.010 — .027	2	24	O, H24, H18
.028 — .128	2	36	

(Continued Next Page)

ROLLED COMMODITIES

(CONTINUED)

COILED STRIP—ALLOY AA.M57S

Thickness inch	Minimum Width inch	Maximum Width inch	Available Tempers
.010 — .035	2	14	O, H34, H38
.036 — .128	2	36	

CIRCLES—ALLOYS AA.2S, AA.3S, AA.M57S

Thickness inch	Dia. Blanked inches		Dia. Sheared inches		Dia. Sawn inches		Available Tempers
	Min.	Max.	Min.	Max.	Min.	Max.	
.010 — .128	2¾	12¾	5	60	—	—	All Tempers
.129 — .250	6¾	14¼	8¼	60	—	—	
.251 — .375	—	—	—	—	7	48	

STANDARD BLANK SIZES

Toolage is available for the production of circles in the following diameters and gauges. For diameters and gauges other than those tabulated, circles would be produced by circle shearing or sawing. Circles produced by shearing or sawing may be subject to edge defects such as ridging with heavy gauge material and burr in all gauges and should only be used where minor edge defects are not critical.

THICKNESS, 0.010" — 0.128"												THICKNESS, 0.129"-0.250"				
2¾	3⅛	3⅜	3¼	3½	3⅝	3¾	3⅞	4	4¼	4½	4¾	6¾	7	7¾	8	8⅝
4⅞	5	5¼	5⅜	5⅝	7¾	6	6⅛	6¼	6⅜	6½	6⅝	8¾	9	9½	9¾	10
6¾	6⅞	7	7¼	7½	7⅜	7¾	7⅞	8	8¼	8⅜	8½	10⅝	10¾	10⅞	11	11⅜
8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	10	10¼	11½	12	12½	13⅝	13¾
10⅜	10½	10¾	11	11¼	11⅜	11½	11¾	10⅞	12	12½	12¾	14¼				

PLATE—ALLOYS AA.2S, AA.3S, AA.65S

Thickness inch	Min. Width inch	Max. Width inch	Max. Length inch	Available Tempers
.250 — .375	20	48	144	—O —F

AUSTRALUCO ALUMINIUM ALLOYS

LIMITS OF MANUFACTURE

EXTRUDED COMMODITIES

Australuco manufactures a wide range of extruded commodities including solid sections, hollow sections, rods, bars, wire and tubing.

Requirements outside the limits and tolerances outlined below should be the subject of a special enquiry.

ALLOYS

Sections, rod and bar — AA.2S. AA.50S. AA.51S. AA.B62S.
Extruded tubing — AA 2S, AA.50S, AA.51S.
Drawn tubing — AA.2S, AA.50S, AA.65S.
Wire — AA.2S, AA.50S, AA.65S.

SURFACE FINISH on sections, rod, bar and extruded tubing—

Finish No. 1 — all alloys — not controlled for uniformity.
Finish No. 2 — AA 2S, AA.50S, AA.51S, — Uniform and suitable for decorative architectural work, but will not buff without cutting.
Finish No. 3 — AA.2S, AA.50S—suitable for buffing available on faces 1" wide and under only.

SURFACE COLOUR

Alloys AA.50S and AA.51S in the T4A and T5 condition and all alloys in the –F condition will have a bright unstained appearance. All other extrusions will be subject to dark heat treatment stains which can be removed mechanically or chemically.

DIMENSIONAL LIMITATIONS

SECTIONS — MINIMUM WALL THICKNESS — In.

Diameter of Circumscribing Circle — in.	SOLID SHAPES		HOLLOW SHAPES		
	AA.2S. AA.50S	AA.51S A.A.33S AA.65S	AA.2S	AA.50S	AA.51S
Up to 1.00	.040	.050	.040	.050	.070
1.01 to 2.00	.040	.050	.048	.060	.090
2.01 to 3.00	.045	.055	.060	.080	.120
3.01 to 4.00	.050	.060	.080	.100	.150
4.01 to 5.00	.055	.070	.150	.200	.300
5.01 to 6.00	.060	.080	.200	.250	.350
6.01 to 7.00	.080	.120	—	—	—
7.01 to 8.00	.100	.160	—	—	—
8.00 to 9.50	.125	.250	—	—	—

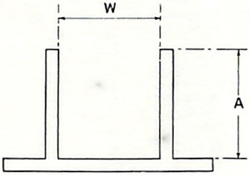
(Continued Next Page)

EXTRUDED COMMODITIES

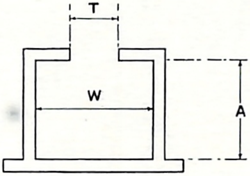
(CONTINUED)

SECTIONS—Deep Channels and Re-entrants

Deep channels and re entrants can be produced, but should be avoided, where possible, as they increase the price of the section.



Keep A less than 2W



Keep W less than 2T
Keep A less than 2W

ROD & BAR—SIZE RANGE

Shape	Minimum - In.	Maximum - In
Round (diameter)	0.375	7.000
Square (a/f)	0.375	5.00
Hexagon (a/f)	0.375	6.00
Rectang!e (w x t)	.375 x .062	9" x 1" 7" x 2" 6" x 3"

Sizes under .375" are classified as wire.

WIRE

Diameters and a/f from .060" to .374".

DRAWN TUBING	Min.	Max.
Outside Diam.	0.250"	5.00"
Wall Thickness	0.036"	0.500"

EXTRUDED TUBING	Min.	Max.
Outside Diam.	0.375"	5.250"
Wall Thickness	0.036"	0.500"

Australuco ALUMINIUM ALLOYS

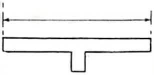
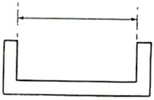
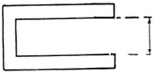
TOLERANCES

Extruded Commodities

Australuco extruded sections are produced to relatively fine dimensional tolerances, but it is not possible to achieve tolerances equivalent to those of a machined component, and this must be taken into consideration when mating fits are required with other components of an assembly.

Standard tolerances are supplied with every approval drawing. The following abridged tables will give some idea of the standard tolerances. Where dimensional control is vital please discuss this problem with our nearest Sales Branch Office.

CROSS SECTION DIMENSIONS

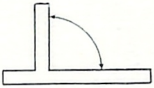
Dimension	 Tolerance on Solid Metal	 Tolerance on Shallow Channel	 Tolerance on Deep Channel
.064 — .149	.007	.010	.016
.150 — .199	.008	.012	.018
.200 — .299	.008	.013	.020
.300 — .399	.009	.014	.022
.400 — .499	.010	.015	.024
.500 — .749	.011	.016	.026
.750 — .999	.012	.018	.030
1.000 — 1.499	.015	.020	.038
1.500 — 1.999	.018	.024	.046
2.000 — 2.499	.021	.028	.054
2.500 — 2.999	.024	.032	.062
3.000 — 3.999	.027	.036	.068
4.000 — 4.999	.030	.040	.078
5.000 — 5.999	.035	.044	.088
6.000 — 6.999	.040	.048	.100
7.000 — 7.999	.045	.054	.112
8.000 — 8.999	.050	.060	.120
9.000 — 10.000	.055	.064	.135

TOLERANCES

Extruded Commodities

(CONTINUED)

ANGLES



Thickness of Thinnest Leg (inch)	Allowable Deviation (Degree)
Up to 0.199	Plus or Minus 2
0.200 — 0.729	Plus or Minus 1½
0.750 and over	Plus or Minus 1

Twist and Straightness

Diameter of Circumscribing Circle	Under 1.5″	1.5 to 2.9″	3.0″ up
Twist per foot run	1°	½°	½°
Total twist in length	—	5°	3°
Straightness	.20″ in 6′	.15″ in 6′	.15″ in 6′

Weight Per Foot

As dimensions vary within tolerance so will the weight per foot of the section. New dies produce a section under nominal weight and are run to a maximum of 10% over nominal weight, unless dimensional tolerances have been exceeded first.

TOLERANCES

Rolled Commodities

Flat Sheet — Thickness

Nominal Thickness inch	Up to 24" wide		Over 24" wide to 36" wide		Over 36" wide to 48" wide		Over 48" wide to 60" wide	
	Plus in.	Minus in.	Plus in.	Minus in.	Plus in.	Minus in.	Plus in.	Minus in.
.012 to .020	.002	.002	.002	.002	—	—	—	—
.022	.002	.002	.002	.002	.003	.003	.004	.004
.024	.002	.003	.002	.003	.003	.004	.004	.004
.028	.002	.003	.002	.003	.003	.004	.004	.005
.032	.002	.003	.003	.003	.004	.004	.004	.005
.036	.002	.003	.003	.003	.004	.004	.005	.005
.040	.003	.003	.003	.003	.004	.005	.005	.005
048	.003	.003	.003	.004	.004	.005	.005	.006
.056	.003	.004	.004	.004	.005	.005	.006	.006
.064	.003	.004	.004	.005	.005	.005	.006	.007
.072 to .080	.004	.004	.004	.005	.005	.006	.006	.007
.092	.004	.004	.004	.005	.006	.006	.007	.007
.104	.004	.005	.005	.005	.006	.006	.007	.007
.128	.004	.005	.005	.005	.006	.007	.008	.008
.192	.005	.005	.006	.006	.007	.008	.009	.009
.249	.006	.006	.007	.008	.009	.009	.010	.010

Coiled Sheet — Thickness

Nominal Thickness inch	Up to 24 in. wide inch		Over 24 in. Up to 36 in. wide inch	
	Plus	Minus	Plus	Minus
.010 to .028	.001	.002	.002	.002
.032 to .056	.002	.003	.002	.003
.064	.002	.003	.003	.004
.072 to .080	.003	.003	.003	.004
.092 to .104	.003	.004	.004	.004
.116 to .128	.004	.004	.004	.005

TOLERANCES

Rolled Commodities

(CONTINUED)

Flat Sheet — Width

Nominal Thickness inch	Allowable deviation from specified width Plus or Minus — Inch		
	Under 24''	24'' to under 48''	48'' to 72''
Under .048''	1/16''	3/32	5/32
.048'' — .127''	3/32	1/8	3/16
.128'' — .249''	1/8	5/32	3/16

Flat Sheet — Length

Nominal Thickness inch	Allowable deviation from specified length Plus or Minus — Inch					
	Under 24''	24'' to under 48''	48'' to under 96''	96'' to 144''	Over 144'' to under 156''	156'' to 216''
Under .048''	1/16	3/32	5/32	3/16	—	—
.048'' — .127''	3/32	1/8	3/16	1/4	9/32	5/16
.128'' — .249''	1/8	5/32	3/16	1/4	9/32	5/16

Coiled Sheet — Width

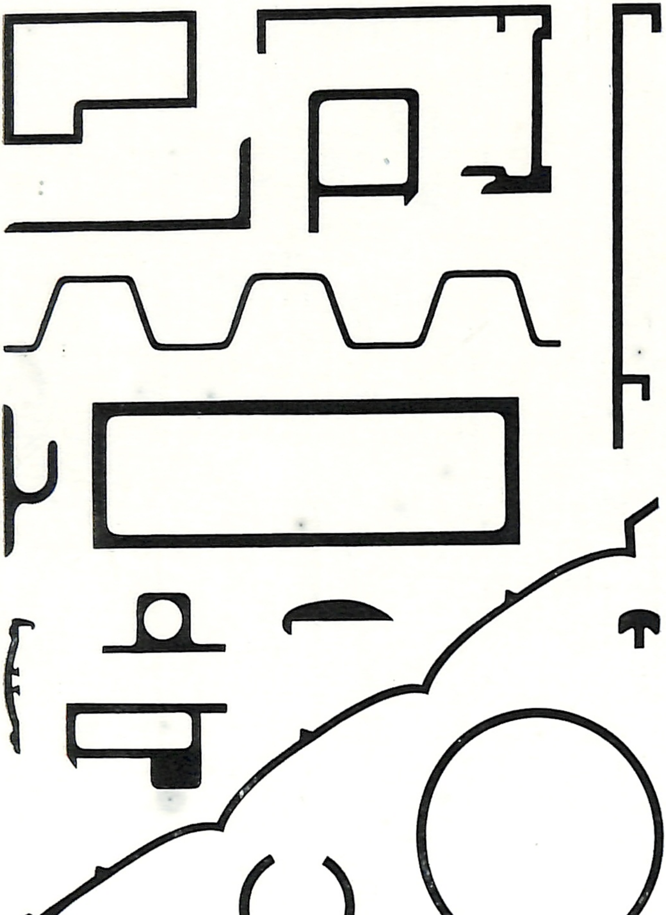
Nominal Thickness inch	Allowable deviation from specified width of Coil — Inch									
	1/2'' - 4''		Over '' 4'' - 16		Over 16'' to 24''		Over 24'' to 30''		Over 30''	
	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus
Under — .048	1/64	1/64	1/32	1/32	1/32	1/32	3/64	3/64	1/16	1/16
.048 — .128	1/32	1/32	1/32	3/64	3/64	3/64	3/64	3/64	1/16	1/16
.129 — .249	—	—	—	—	—	—	1/8	1/8	1/8	1/8

For Sheet commodities requiring tolerances finer than those given in the preceding tables a special enquiry will be required.

AUSTRALUCO ALUMINIUM ALLOYS

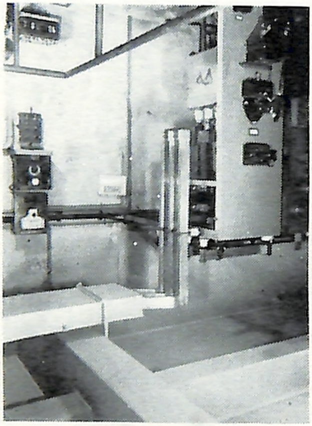
EXTRUSIONS

The sections illustrated here are not to scale but are typical of the range of shapes produced. Hollow or solid shapes can be extruded "tailor made" for the application. By using extrusions many unnecessary joining and machinery operations are eliminated.

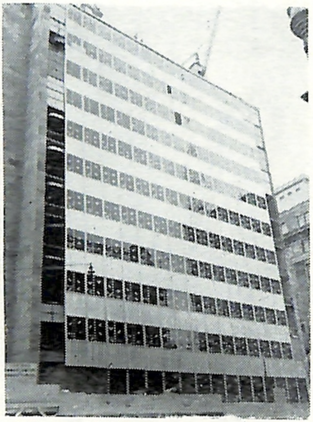


AUSTRALUCO ALUMINIUM ALLOYS

APPLIED

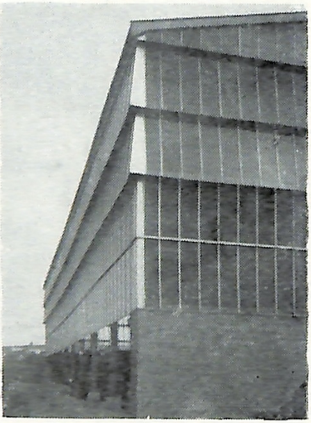


ALUMINIUM Electrical
Bus-Bar Installation



ALUMINIUM Curtain
Wall on Commonwealth
Savings Bank of
Australia—Sydney

ALUMINIUM tipping
body for cartage
of coal



ALUMINIUM
"Aluminex" glazing
bars in factory building

PROCESSING

Deep Drawing

Aluminium lends itself readily to deep drawing, particularly the special deep drawing quality AA.2S. Other alloys, including AA.3S, AA.54S, AA.M57S and AA.65S are also available in deep drawing qualities.

The following points must be carefully watched for the successful deep drawing of aluminium and its alloys—

TOOL DESIGN:

Tools should be made of a high grade tool steel and polished to a high finish. To allow free movement of the metal during deep drawing the provision of sufficient punch and die radii is essential. For annealed materials, the radii should be a minimum of four times the blank thickness and for temper materials increased proportonately to a maximum of twelve times the metal thickness. If the radius is too small, fracture may occur, and if too large buckling may result.

Sufficient clearance between the punch and the die must be maintained to prevent pinching, excessive stretching and possible fracture. A clearance of 10%-20% of the blank thickness in addition to the actual blank thickness on each side of the punch should be allowed.

REDUCTIONS:

The percentage reduction for a circular hollow is calculated by dividing the difference between the blank diameter and the diameter of the drawn hollow by the blank diameter, and expressing this ratio as a percentage. For AA.2S—O in gauges .022" to .125" the first draw may be 40-50% reduction and subsequent draws 20-30% reduction. Corresponding figures for tempered and heat treated alloys are 25-30% for first draws and 15-25% for subsequent draws.

DRAWING SPEEDS:

These usually vary between 100' per minute and 30' per minute for soft ductile alloys and tempered and heat treated alloys respectively.

LUBRICANTS.

Lubricants include mineral oils, paraffin, lard and tallow, singly and in proprietary blends. As a general rule, thin gauge material requires a less viscous lubricant than thicker gauge material.

Special plastic films are available in Australia which can be sprayed or roller-coated on to the aluminium sheet prior to deep drawing and which will completely protect the sheet surface from handling marks and scratches. In addition to this, no drawing lubricants are required when such plastic films are used.

(Continued Next Page)

PROCESSING

(CONTINUED)

Spinning:

Spinning is the shaping of a sheet metal by pressing it against a rotating chuck or former with a highly polished forged or cast steel tool.

Aluminium alloys normally used for spinning include the **softer** grades of alloys such as AA.2S, AA.3S; and AA.M57S. The chuck must be as smooth as possible and may be of wood, aluminium or steel, depending on the number of spinnings required and the hardening characteristics of the alloy chosen

Lubrication of the aluminium surface is essential. Suitable lubricants include soap, tallow, grease, wax or lard oil.

The blank size used should have an area equivalent to that of the finished article. The thickness of the blank should be selected bearing in mind that slight thinning occurs during spinning The speed of spinning should be regulated to approximately 3000 peripheral feet per minute.

Machining

The advantages which aluminium alloys have, making them very suitable for machining, are—

> High thermal conductivity, which conducts heat away from the tool point,
>
> Lightness (one-third weight of steel or brass), which reduces the inertia force when machining large stock at high speeds.
>
> Low shear and elasticity moduli, which facilitate cutting and reduce the energy required to perform the machining operation.

On the other hand it has a relatively high co-efficient of friction on steel which necessitates the use of highly polished tool surfaces and good lubrication.

Aluminium is normally machined at very high surface speeds, using moderate cuts and feeds. Factors which affect these conditions include the type of machining operation, the alloy and temper of the machining stock, the tool material, type of cutting compounds used and the nature of the cut (roughing or finishing, etc.). The use of adequate amounts of cutting compounds of the soluble oil type or paraffin derivatives, such as kerosene, and light cutting oils is essential to ensure a smooth machined surface and to minimise build-up on the cutting edge of the tool.

The selection of a tool material and correct cutting angles depend on the cutting speed to be used, the length of the machining run and the type of alloy being machined. High carbon tool steels

(Continued Next Page)

AUSTRALUCO ALUMINIUM ALLOYS
PROCESSING

(CONTINUED)

are used with low cutting speeds and short runs for small drills, reamers, dies and taps. Hight speed steel tools are used for higher cutting speeds and longer production runs. For both of these types of tools top rake angles should be 30° to 50° and clearance angles 6° to 10°. Tungsten carbide tipped tools are used for the highest cutting speeds and longest production runs. They are particularly suitable for machining high silicon alloys. The cutting angle should range from 52°-95° with a clearance angle of 3°-10°.

Of special importance where automatic screw machine products are to be manufactured in Australuco's specially developed free machining alloy AA.B62S—T6. It is available as round and hexagon bar stock in a range of standard bar sizes. The excellent free cutting and chip breaking characteristics of this alloy result from the presence of small amounts of lead and bismuth incorporated in this high strength (30 tons tensile) alloy.

Bending:

For the many methods of bending aluminium the following general rules apply. First, all metal surfaces which contact the aluminium must be clean and smooth. Secondly, some form of lubrication is highly desirable if the metal surface quality is to be maintained.

The following bend radii are minimum for 90° cold bending of the various alloys, tempers and gauges quoted. Actual bend radii used in practice may be smaller or greater, depending on the condition of the tools and the equipment used.

ALLOY & TEMPER	SHEET THICKNESS, Inch.										
	.018	.022	.028	.036	.048	.064	.080	.104	.128	.187	.249
	BEND RADII IN 32nds. OF AN INCH.										
AA2S—O	0	0	0	0	0	0	0	0	0	0	0
—H12	0	0	0	0	0	0	0	0	0	3	6
—H14	0	0	0	0	0	0	0	0	0	3	6
—H16	0	0	0	0	1	2	3	3	4	8	16
—H18	1	1	1	2	3	4	5	6	8	16	32
AA3S—O	0	0	0	0	0	0	0	0	0	0	0
—H12	0	0	0	0	0	0	0	0	0	0	0
—H14	0	0	0	0	0	0	0	1	2	4	8
—H16	0	0	0	1	2	3	4	5	6	12	24
—H18	1	1	2	4	5	6	7	9	12	24	40
AAB26S—O	0	0	0	0	0	0	1	3	4	6	12
—T4	1	1	2	2	3	4	6	9	12	20	40
—T6	2	3	3	4	6	8	12	17	24	35	48
AAM57S—O	0	0	0	0	0	0	0	0	0	0	0
—H32	0	0	0	0	0	1	2	3	4	8	12
—H34	0	0	0	0	1	2	3	4	6	12	24
—H36	0	0	1	1	2	3	4	6	8	16	32
—H38	1	1	2	3	4	6	9	12	16	30	48
AA65S—O	0	0	0	0	0	0	0	0	0	2	4
—T4	1	1	2	2	3	4	5	6	8	16	32
—T6	1	1	2	2	3	4	5	6	8	16	32

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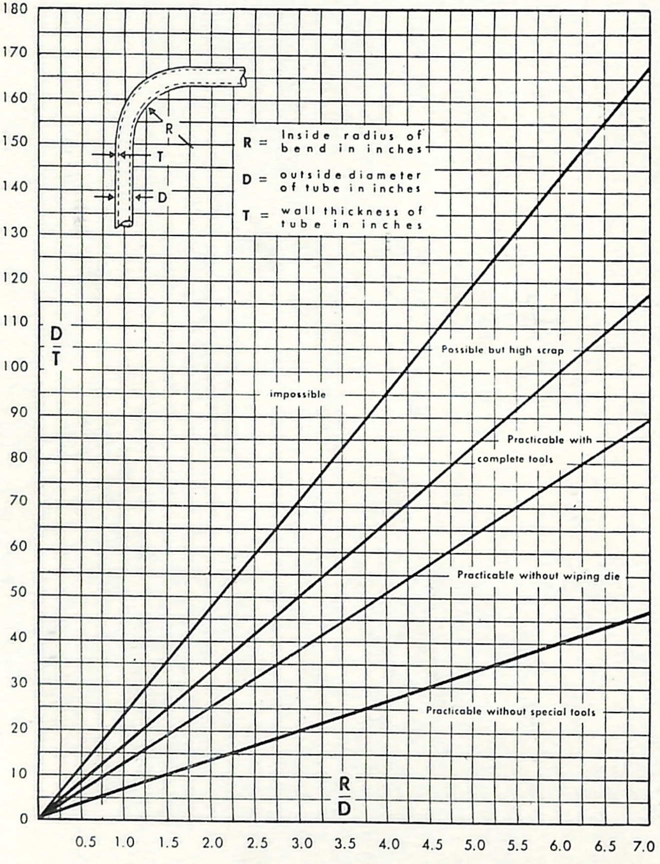
BENDING CHARACTERISTICS
OF AA.65S—T4 TUBING



This chart should be used only as a guide. In general, alloys and temper of lower strength will take smaller bend radii than those indicated on the chart, while those of higher strength will require larger bend radii for equivalent sizes.

SURFACE FINISHING

Etching

Caustic soda is the prinicipal etching agent used for producing a matte-frosted finish on aluminium. The solution is generally 5-10% caustic soda in water and is operated at 140-180°F for varying periods of time depending on the depth of the etch required from 1-6 minutes. Should smut develop on etching, a rinse in 25% nitric acid at room temperature should remove it.

Scratch Finish:

Scratch brushed finishes are usually produced by stroking the aluminium sheet or section with a 10" diameter brush having stainless steel or nickel silver wires. The coarseness of the scratch texture is controlled by varying the diameter of the wire from .002" in diameter up to .010" in diameter. The brush should revolve at a speed of approximately 2000 r.p.m. It is most important that all surfaces to be scratch-brushed should be free of oil and foreign matter. Alternatively, a scratch finish may be obtained by belt-sanding with an abrasive coated cloth belt as with the first step in polishing.

Polishing:

Three steps are usually taken in polishing aluminium articles, viz. greasing which is carried out with a belt sander or emery bob faced with 100-200 mesh grit. A speed of 6000 f.p.m. is used, together with lubricants such as tallow or bees wax to prevent overheating.

Buffing is usually done with stitched muslin or canvas mops and a fine abrasive, such as tripoli, in a grease binder. Speeds of 7,000 f.p.m. are used.

Colouring is used to produce a very high gloss as a finishing operation. A soft muslin buff and Sheffield lime, or very fine silica and grease are used. Polishing speed is about 8,000 f.p.m.

Anodising:

Anodising is an electrochemical method of thickening the natural oxide film always present on the surface of aluminium and its alloys. Whereas the natural film is always 5-8 millionths of an inch thick, anodising increases this film by .0002" to .001" in thickness.

The most commonly used method for anodising aluminium is as follows—

Bath Composition: 12-15% sulphuric acid by volume.
Bath Temperature: 70°F (+ or — 4°F.)
Current Density: 10-12 amps. per sq. ft.
Voltage: 10-15 volts according to bath composition, temperature and arrangement of work.

Time will vary according to the thickness of film required from 10 minutes to 60 minutes in the above bath.

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SURFACE FINISHING

(CONTINUED)

Should a BRIGHT anodised finish be required, the article should be chemically brightened prior to anodising. The most employed types of chemical brightening baths are those composed of 93% phosphoric acid and 7% nitric acid operated at approximately 100°C for ½ to 3 minutes, or a bath containing 75% phosphoric acid and 25% sulphuric acid operated at 110°C for 1-3 minutes. The article must be thoroughly rinsed in hot water immediately following this brightening treatment and then anodised as soon as possible thereafter.

Painting:

To obtain a good paint coating on aluminium and its alloys the aluminium should be thoroughly de-greased and given some pre treatment, either chemical or mechanical, which will roughen the surface and thus enabe the paint to "key" to it. The most satisfactory and simple method of pre-treating the aluminium is to coat it with a self-etching primer containing phosphoric acid and zinc chromate. With this preparation, any type of standard paint finish may then be applied. Under very severe conditions a scratch brush finish will provide the best key.

STORAGE

Sheet and extruded commodities are usually delivered with a surface that with moderately careful handling in storage will require no further treatment. For prolonged storage a coating of lanolin may be desirable to preserve the finish. Storage should give protection against rain, but ventilation under cover is necessary to prevent atmospheric condensation, which is more troublesome than direct contact with water. Plate and sheet should be stacked on edge, not flat, with airways around and under the sheet. Tubes and other sections should also be stored vertically. This method of storage will reduce damage from scratches and distortion as components may be lifted, not dragged, out of store. Thin tubes and sections must be well separated if they have to be laid horizontally.

Because of atmospheric condensation packing cases should be opened and material stacked as soon as possible. This procedure will avoid surface staining and marking.

JOINING

Riveting

Riveted joints in aluminium alloys are effected in the same manner as with steel, however, it is necessary that the rivet holes are well filled. Solid or hollow rivets of all types are used, but precautions are necessary against the possibility of galvanic action if other than aluminium rivets are employed. Pneumatic squeeze equipment is best for solid rivets up to approximately 5/16" diameter. Above 5/16" heavy pneumatic hammers are generally more satisfactory.

Bolting:

To minimise the possibility of bolts working loose in service it is necessary to ensure that they are a neat fit in the holes. This is best effected by reaming or using an undersize drill for preparation. Aluminium alloy, stainless steel, cadmium plated or electro galvanised steel bolts may be used, preference being in that order.

Gas Welding:

Most gas welding of aluminium is performed with an oxyhydrogen or oxyacetylene flame, a special flux and a filler rod of 5% silicon aluminium alloy or of similar composition to the metal being welded. Gas welding is normally confined to materials 1/32" to 1/8" thick, and the alloys most suitable for joining by this process are AA.3S, AA.M57S, AA.50S, AA.51S, AA.56S and AA.65S.

Fluxes used for gas welding are highly corrosive and must be thoroughly removed after welding. Boiling water, live steam or dilute (5-10%) nitric acid is used.

Arc Welding

METALLIC ARC:

Metal arc welding is usually done with flux coated electrodes using Direct Current, and reverse polarity (work negative). Flux coatings must be moisture free, otherwise serious porosity can occur in the weld bead. Recommended minimum thickness for butt and fillet welds is 1/8".

Material over ¼" thick should be given a 60°-90° bevel and have a shoulder between 1/16" and 1/8" thick. Backing strips of copper, steel or graphite, with a groove ½" wide x 1/8" deep should be used to obtain complete penetration and prevent burning. Thick material should also be pre-heated to 250°F-400°F.

Filler rods of 5% silicon-aluminium alloy or of similar composition to the parent metal may be used. A short arc (1/8" to 3/16") is used for its stability. All traces of flux should be removed after welding.

(Continued Next Page)

JOINING

(CONTINUED)

ARGON TUNGSTEN ARC AND ARGON CONSUMABLE ELECTRODE ARC WELDING METHODS:

The chief advantages of these two processes are:

(a) No flux is required, so that after-cleaning is eliminated.

(b) Sound welds of good appearance can be laid down at high speed.

(c) Good results can be obtained without especially high skill being required.

It is normal to use a transformer with high open circuit voltage and a high frequency high voltage generator to maintain the arc for argon arc welding. For argon shielded consumable electrode welding special D.C. reverse polarity equipment is used and the deposition of weld metal is in the nature of a spray. Both types of equipment are readily available in Australia.

The consumable electrode method as its name implies makes use of the electrode as a filler wire. It is relatively fast and economical and is suitable for material of thickness greater than 1/8". The argon arc method is not so economical, but it is suitable for material of thickness above 18 s.w.g. The latter method employs a separate filler wire either of parent metal or 5% silicon rod.

Material to be welded should be thoroughly cleaned and de-greased, then scratch brushed immediately prior to welding.

Resistance Welding:

Resistance welding is used for joining almost all aluminium alloys and more particularly the high strength copper and zinc bearing alloys. It uses the heat generated by the passage of a heavy electric current and pressure to form the joint. It replaces riveting and has the advantage over gas welding that there is practically no loss of strength.

There are three main types of resistance welding, namely—spot, seam and flash butt.

(Continued Next Page)

JOINING

(CONTINUED)

General Note on Welding:

It is important to note that all welding methods will reduce the mechanical strength of the metal in the area of the weld zone. These strength losses vary with different alloys and with the technique of the welder.

Before using welding methods for load carrying members, it is recommended that Australuco Technical Service be consulted regarding the selection of the alloy and the most suitable method of welding.

Brazing:

Brazing differs from welding in that the parent metal is not melted. The filler rod is usually an aluminium 10% silicon alloy melting at approximately 600°C which fills the closely fitting joint by capilliary attraction. Commercial alloys such as AA.2S, AA.3S, AA.50S, AA.51S, AA.M57S and AA.65S may be joined by this process. Depending on the method of brazing the degree of surface cleaning and preparation will vary.

Furnace brazing requires the most care, even to the extent of retouching the surface, while general cleanliness is required for torch and salt bath brazing.

Fluxes used in brazing are highly corrosive and should always be completely removed by rinsing in warm (150°F) dilute (5-10%) solutions of sulphuric or nitric acid.

Soldering:

Aluminium can be joined effectively by soft soldering, provided special techniques are employed. The main problem in soldering is to remove the tenacious oxide film which is accomplished most satisfactorily by first thoroughly cleaning the surface, followed by scratch brushing and then tinning with a special solder containing 45% tin, 49.5% zinc and 5.5 % antimony.

Tinning is carried out by abrading the surface under the molten solder film with a solder stick. All traces of residual flux must be removed after soldering with dilute acid solutions as for gas welding.

AUSTRALUCO ALUMINIUM ALLOYS

APPLICATIONS

Set out below is a list of applications in which aluminium is used. The wide range illustrates the versatility of this durable, strong, lightweight metal—

Aircraft
Barrels
Cables
Bridges
Bus-Bar
Concrete Forms
Railway Rolling Stock
Connecting Rods
Collapsible Tubes
Tipping Trucks
Pantechnicons
Ship's Superstructures
Light Fittings
Refrigerators
Bobbins
Horse Shoes
Shop Fittings
Shelving
Gardening Implements
Wall Cladding
Scaffolding
Screws
Milking Machines
Fishing Reels
Cigarette Boxes
Surgical Instruments
Statuary
Buckles
Pasturisation Equipment
Sewerage Plant
Road Signs
Pens
Fencing
T.V. Antennae
Cabinets
Bottle Closures
Cans
Ceilings
Cranes
Refrigerated Containers
Crank Cases
Window Frames
Semi-Trailers
Handrails
Lifeboats
Transmission Wire
Washing Machines
Gear Casings
Labels
Trays
Silos
Reflectors
Flashing
Rivets
Irons
Printing Plates
Billiard Cues
Jewellery
Lifts
Gantries
Suit Cases
Agricultural Machinery
Grilles
Hospital Equipment
Pencils
Beakers
Awnings
Baskets
Cameras
Buses
Churns
Doors
Pistons
Radio Shields
Architectural Fittings
Vans
Petrol Tanks
Dinghies
Cooking Utensils
Chemical Vats
Vacuum Cleaners
Furniture
Hardware
Irrigation Tubing
Roofing
Ladders
Nails
Fish Boxes
Pre-fabricated Buildings
Golf Buggies
Buttons
Escalators
Conveyors
Trunks
Louvres
Roller Shutters
Fire Fighting Equipment
Fly Screens
Damp Coursing

Notes

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